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An American View of the Swiss Semiconductor Industry

J.A. Hoerni

Microelectronics in Switzerland is like the weather in England: Everybody talks about it, but nobody seems to do anything about it. From his vantage point in Silicon Valley since the late 1950s, the author has observed with some frustration the inability of the Swiss industry to face the challenges of microelectronics, and in particular, to take a meaningful position in the field of semiconductors. This paper will discuss how certain Swiss contributions in this field are still possible, provided that improvements take place in the business climate to favor the creation of new technological enterprises.

Past Events

About 15 years ago, Switzerland had a unique advantage. It had a leading industry, the watchmaking industry, which was in the position to absorb a large amount of integrated circuits (IC) of the standard variety, certainly the dream of every chip manufacturer. Ebauches Electronics SA was set up at Marin as a prospective large-scale manufacturer, but two mistakes were made.

First, the company was under direct control of a watchmaking organization, which was primarily interested in a captive source of frequency divider chips, and made no great effort to develop in parallel other lines of IC products, in order to lessen the company's dependence on the conjuncture of the watch industry. An attempt at such a diversification was made through a licensing agreement for non-volatile memories, but production was halted when no orders from domestic customers were forthcoming while the possibility to market the product outside of Switzerland had been totally neglected.

The second mistake was due to a typical complex of inferiority in matters of technology. This complex is shared in practically every European country, in absolute contrast to Japan. This is probably due to the European misconception that a new venture in semiconductors can only be started within one large existing organization and that the needed know-how has to be acquired from a similarly large organization, preferably in the USA. Little was it recognized that in the USA successful start-ups, such as Fairchild, Intel or AMD in the old days, or most of the recent ones, were founded by a very small number of talented individuals, financed by an equally small number of venture capitalists. This European misconception could only discourage potential entrepreneurs and

keep them disinterested in participating in such large bureaucratic projects. The lack of confidence in the competence of its own technical people has led the Swiss semiconductor industry to abdicate its responsibility for technology improvement to such remote entities as Eindhoven and Newport Beach.

The Present Situation

Present conditions have changed, of course, mostly because Switzerland can no longer provide a large internal market to support a high volume of standard chips, whether watch chips or other commodity items such as memories and microprocessors. (Production of watch circuits would actually be more economically carried out by Far Eastern suppliers.) To a foreign observer, it appears that the present philosophy in Swiss industrial circles is to concentrate on software development and, in the field of hardware, on new electromechanical products in such fields where Switzerland has been traditionally strong, including measuring instrumentation, computer peripherals, machine tools, medical electronics, power control, etc. At the same time the general opinion is that it is too late, or too expensive, to develop an IC industry to support these ambitious new products, and that there are enough foreign chip suppliers to meet all requirements of the Swiss market.

What is overlooked, however, is that the end products under consideration require small to medium quantities of specialized circuits, which can be best implemented as either full-custom or (for cost and quick turnaround reasons) as semi-custom circuits. Clearly the design rules for such circuits will be dictated by the manufacturing processes used by the external wafer foundries which are to produce the chips. Such processes are mostly directed

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towards the largest possible applications, i.e. digital applications. On the other hand, the "Swiss" chips will in most cases include a variety of extra features, such as components operating at high voltage or high current, components optimized for analog applications, chip programmability and reprogrammability at the user's level.

Considering the future products listed above, high-voltage ICs will be needed in certain medical applications; they will also be used in solid-state relays and as drivers of electroluminescent or plasma displays in new peripherals. High-current ICs (also called Intelligent Power ICs) will find a place in systems for fluorescent light control and motor speed control. Measuring instrumentation will require transistors, capacitors and other components specially optimized for analog circuitry, such as in the case of interfacing with external sensors. Finally, the inclusion of (re)programmable elements of the EPROM or EEPROM variety will be invaluable in allowing calibration of precision analog circuits or, in a different context, in allowing the final user to modify his semi-custom circuits without vendor's assistance and without the need of any mask redesign.

It is evident that none of the existing wafer foundries are in a position to offer this kind of process flexibility. In fact, Swiss semi-custom design houses are obliged to implement their CMOS gate array designs in the obsolete metal gate process, simply due to the lack of available or interested suppliers of a modern silicon gate process.

Chances for Future Success

What are the chances of success of a new specialized CMOS company in Switzerland? In view of recent developments, they may no longer be as bleak as they appeared a few years ago. Technical know-how and manpower are increasingly available, through the formation of new graduates in the IC discipline in Lausanne, Neuchâtel and Zurich, together with the existence of expatriate engineers who would welcome a return home under the right opportunity. In financial circles, it is being slowly recognized that specialized Venture Capital firms, and not commercial banks, should be the source of capital for new enterprises. However, a great deal of education remains to be done at all levels for exploiting this favorable evolution.

The typical Swiss distrust of anything new and different is the main obstacle to the formation of new enterprises. What would have been the local reaction if, for example, the founders of Apple computer had decided to start their company in Switzerland? Instead of looking to the USA for new technology, it would be much more advisable to look to the USA, and Silicon Valley in particular, for its general business mentality, which has helped rather than stifled new start-ups such as Apple Computer and so many others.

The respect for existing institutions, however admirable in other areas, has led Swiss circles to believe that only large, well established companies can succeed in the implantation of new products and technologies. That this concept is absolutely false can be verified by looking at the development of the American semiconductor industry. The success of a new venture is a creative act, hardly the characteristics of management and committees in large companies, which are imbued with the sense of status quo and the NIH ("Not Invented Here") philosophy.

Another objection which has been made is that the investments required by a new IC business are beyond the reach of a new company. Whereas this may be true for high-volume commodity items such as memories and microprocessors, it is far from the case for specialized companies which are precisely of the type advocated in this paper. It is instructive to look at two young companies in Silicon Valley, which interestingly are both in the specialized CMOS business with the added technical features mentioned above (high-voltage/current, programmability). The first company, Supertex, has gone through its initial public offering in December 1983, and the second, Semi Processes, is about to do so in late 1984. At their corresponding stage of growth prior to the public offering, both companies were profitable on annualized sales of about \$ 15 million, and their respective capitalization had remained inferior to \$ 6 million. In comparison the subsidies by the Confederation for continued research in IC technology in Neuchâtel seem munificent.

It then appears that financing is not the factor limiting the formation of new companies. It may rather be the poor prospects facing early investors to "get out" through the sale of part or all of their holdings on the stock mar-

ket, and for subsequent investors to have a similarly liquid investment. The task of making the stock ownership of new issues popular in Europe is a difficult one, but not impossible as has lately been demonstrated in the United Kingdom and in Sweden.

The founders of a new company also have a few things to learn from Silicon Valley. Their professional competence and personal integrity should of course be beyond question, but these are only necessary and not sufficient conditions for future success. A true test of their marketing ability lies in the toughest sale of all, when they will have to convince sceptical investors to invest, new employees to join them, and future customers to do business with them. Again, all of that is much more difficult in Europe. It is not in bad taste for the founders to stress to their prospective investors their own motivation to make a great deal of money for themselves. Lacking this motivation, they might as well continue their work in a university or a research institute. Equally essential is to convey the willingness to assume personal risks and hardship for the cause of the venture. A founder may have to make a personal investment in the venture, even at the cost of mortgaging his home; to work at a salary lower than offered in established companies; to shorten or forgo his vacation time (a heresy in Europe); and finally to work such long hours that his wife will divorce him (US venture capitalists are known for that).

In conclusion, a case has been made for the manufacture of specialized CMOS circuits in Switzerland. The difficulties ahead are not so much technological or financial, as in adapting the conventional Swiss mentality to today's realities of creating new technological enterprises. Due to the continued prosperity, the notion of risk taking, whether on the part of the investors or of the founders themselves, has largely been lost, and must be recaptured if Switzerland wants to remain competitive in world markets. Short of such adaptation, the alternative is clear: Like John Sutter of the California Gold Rush, like the mercenaries of the 15th century, the real innovators will lose patience and continue to emigrate to distant Silicon Valleys, leaving behind bureaucrats and other consulting experts to explain why nothing is done about the weather.